Weather Note

COMMENTS ON A RADAR HOOK ECHO OF THE "REVERSE 6" TYPE

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About noon CST on July 22, 1962 the first echoes of what became a very interesting squall line appeared on the WSR-3 radar at Midway Airport in Chicago, Ill. They were located about 100 mi. north-northwest of the station. During the next 3 hours the situation became more threatening as the echoes evolved into a solid line while moving toward Midway Airport at about 20 kt., and an additional echo area formed ahead of the principal line.

The first indications of tornado-type activity came at 1524 CST with the visual sighting by Weather Bureau observers at Midway of a ragged pendant suspended from the approaching thunderstorm. The pendant was an estimated 4 mi. in the direction of 280° from Midway Airport. It was in the southwest (right forward) quadrant of the thunderstorm echo. At this time the thunderstorm was approximately 15 mi. across and centered about 6 mi. north of the Airport (see fig. 1). Unfortunately the WSR-3 at Midway was not equipped for photography, and therefore only sketches based on the observational record, memory, and notes are available. Just after the sighting of the pendant, the observers noted the rapid descent and ascent of a funnel cloud from the pendant. During a period of about 6 min. the funnel dipped down and returned at least four times, remaining visible for 15 to 30 sec. each time.

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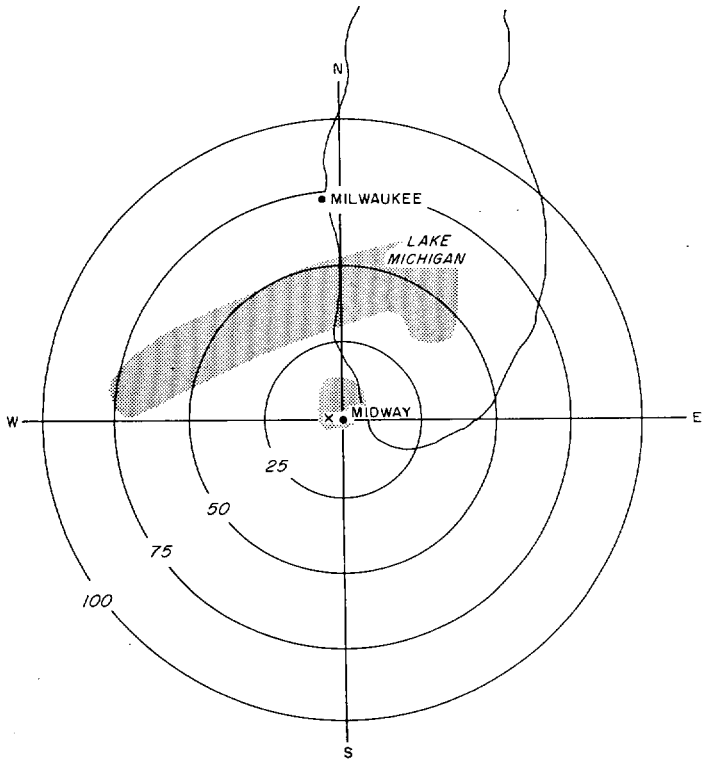

FIGURE 1.—Radar echoes at Midway Airport at 1524 CST. The X indicates the approximate location of the hook echo and funnel cloud. Distances in nautical miles.

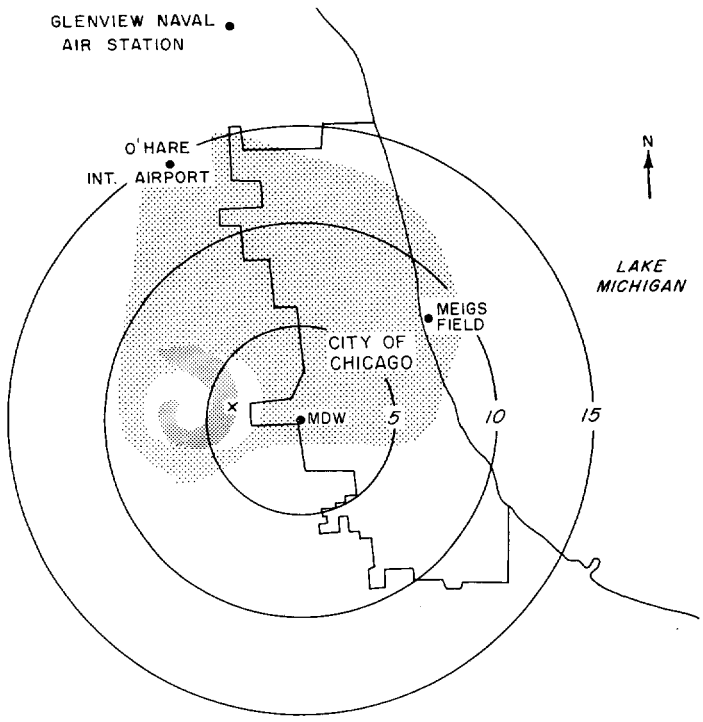

FIGURE 2.—Radar echo at Midway Airport (MDW) at 1524 CST. The X indicates the approximate location of the funnel cloud superimposed on the hook echo.

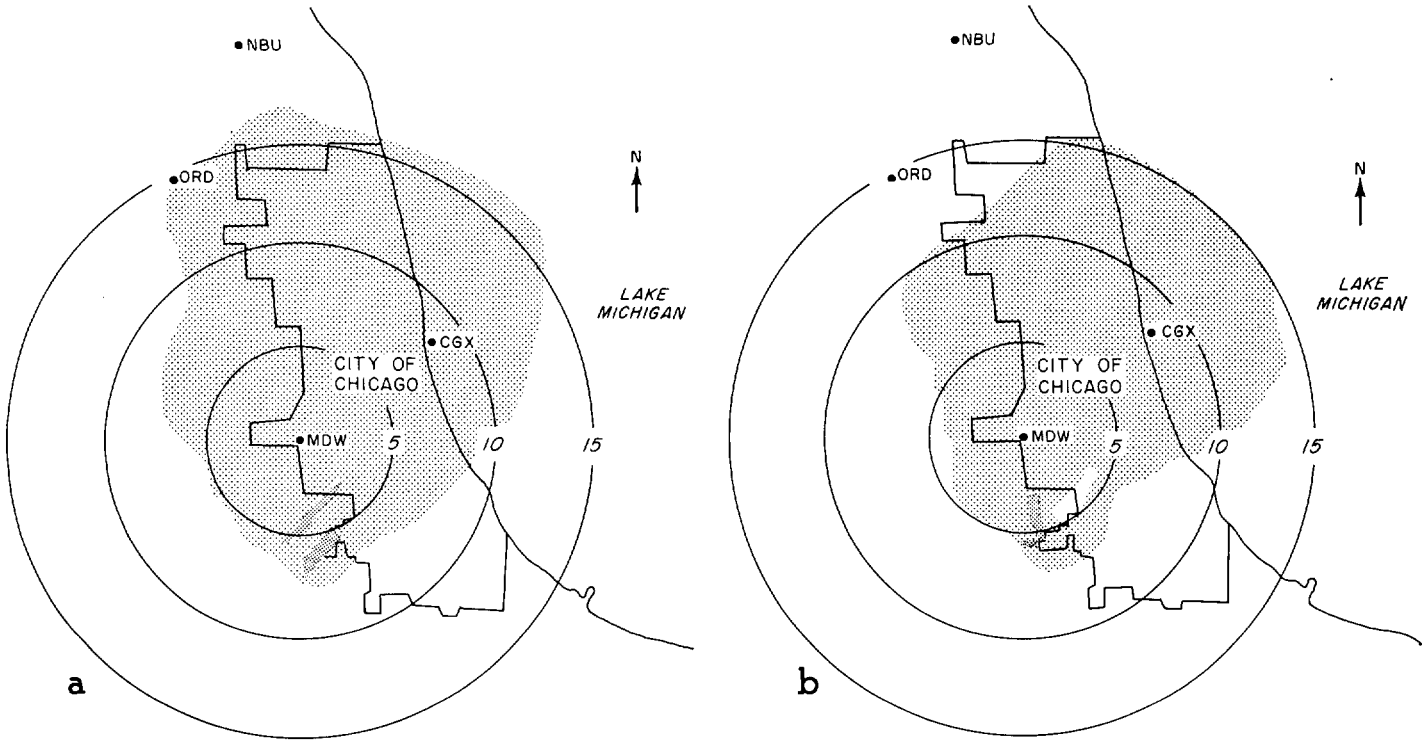

FIGURE 3.—Radar echoes at approximately 1600 CST, illustrating the peculiar shadowy and bright returns.

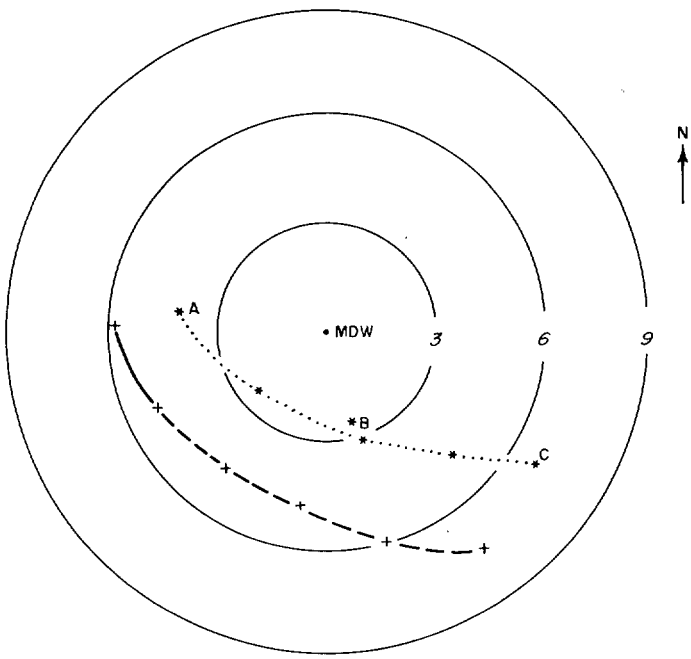

FIGURE 4.—A plot of the assumed path of the funnel cloud (dotted) and of the actual (solid line) and extrapolated (dashed) path of the hook echo.

At the time of the first sighting of the funnel, a hook-shaped echo, centered about 6 mi. west of the station was noted on the radar. (See fig. 2.) The intensity of the hook was quite pronounced compared to that of the thunderstorm cell. During the 15 or so minutes the hook remained visible, its characteristics changed only slightly. It remained visible until about 10 min. after the funnel was visually obscured. The hook may have actually disappeared or merely been obscured by the very strong echoes of the thunderstorm cell which was then centered over the station and producing heavy hail at the station. The hook was last seen on the scope when it was about 5 mi. from the station toward 245°.

For a time after the hook echo was no longer visible, oddly shaped shadows and bright spots were observed on the radar along the extrapolated path of the hook. (See figs. 3a and b.) These features were not due to peculiarities of the radar set, but were real features that were not detected in any other cells in the area. These shadows and bright spots were used to extend the path of the hook echo. (See fig. 4.)

During the half hour following loss of visual contact with the funnel cloud by Weather Bureau observers, several reports of tornadoes or funnel clouds were received by the Weather Bureau, newspapers, radio, and television offices from the public. Weather Bureau personnel con-

firmed damage at three places. Two were about 3 mi. south-southeast and the third about 7 mi. southeast of Midway Airport (points B and C on fig. 4). These damage points along with the public reports were used to extend the path of the funnel cloud. Since the motion of the mother cloud was observed to be toward the southeast, it is apparent from figure 4 that the funnel and hook echo moved cyclonically around at least a portion of the mother cloud, or better stated, that the mother cloud was rotating cyclonically. Further evidence of cyclonic rotation of the mother cloud was obtained from successive positions of the nodule on the leading edge of the cloud, as seen in figures 2 and 3. The short visible life span of the hook echo, however, made it impossible to determine any rotational aspects of the hook itself.

An additional feature of interest in this echo was the presence of a bright banded echo observed on the RHI scope. It was observable only (1) after loss of radar contact with the hook echo, (2) for 2 to 3 min., (3) during the occurrence of hail at the station, and (4) near the top of the thunderstorm cell (approximately 40,000 ft.). It was about 3,000 to 4,000 ft. thick and sloped downward toward the leading edge of the echo. (See fig. 5.) It probably was not associated with melting snow, as is the usual "bright-band" below stratiform clouds, but may have been associated with hail, although the reason for the layer type echo instead of the usual shaft configuration is not apparent.

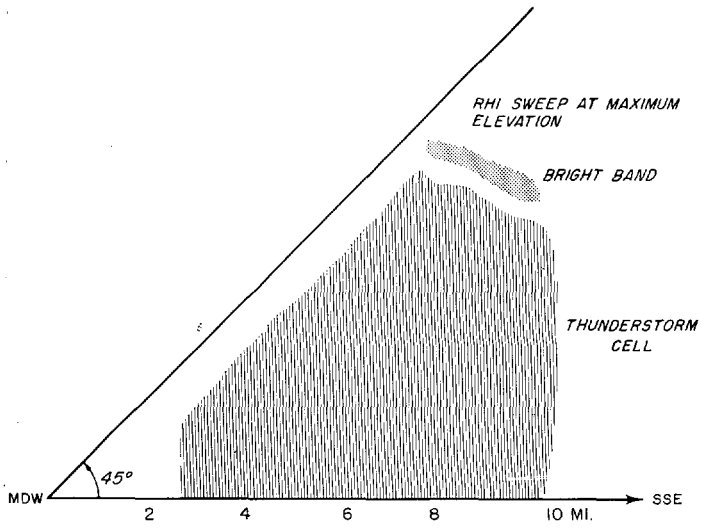

FIGURE 5.—A sketch of the RHI display of the bright band that appeared in the cell that produced the hook echo and funnel cloud. Azimuth 160°; maximum height approximately 40,000 ft.

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